

## WHY BIG GUNS MISS MARK.

Explanation of Apparent Haphazard Shell Fire Read About in Reports.

Capt. H. J. Jones, inspector of ordnance machinery of the British army, tells the factors affecting the accuracy of fire and range of big guns, and gives some causes that will explain the apparent haphazard shell fire that we read of in the reports from the war, and why the shots from big guns so frequently miss their mark, says the engineer.

1. Whip—The whip or transverse vibration of the muzzle portion of long guns may be the source of very large errors. It becomes pronounced with 50-calibre guns, particularly if they lack girder stiffness. The droop of a 12-inch 50-calibre gun is from 0.3 inch to 0.4 inch, and its cantilever stiffness such that it makes from 130 to 150 complete vibrations per second. The velocity of the centre of the muzzle across the line of departure arising from this vibration may be as high as fifty feet per second with wire-wound guns. Assuming the mean velocity along the rifling to be 1,800 feet per second, we see that there will be about three complete vibrations of the muzzle while the projectile is in the gun. The projectile may leave the bore with the centre of the muzzle in any position between its limits of vibrational displacement, and the error in the angle of departure is thus quite indeterminate and fortuitous, and the error of range symmetrically disposed about the mean.

2. Firing Interval—This is the interval between the layer pressing the trigger and the projectile leaving the bore. With moving gun platforms it is the main cause of inaccurate shooting. The firing interval is made up of two parts, one, from 0.08 to 0.13 second, during which time the tube is fired, the charge ignited and the band engraved, and the other, from 0.022 to 0.035 second, representing the time of travel of the projectile along the rifling. In other words, the firing interval for a modern 12-inch gun is, on the average, about 0.122 second. These figures, however, may be greatly exceeded with defective tubes and firing arrangements.

Modern battleships have a meta-centric height of from 3.5 feet to 4.5 feet, and a period of about 8 seconds for a single roll of 5 degrees. This is equivalent to a maximum angular velocity of 15 minutes of angle per 0.10 second. Hence if we assume that the layer does not alter the elevation between the instant of pressing the trigger and the projectile leaving the bore, the average firing interval means a possible error with the 12-inch of 16.3 minutes elevation. Since 1 minute alteration of elevation at 10,000 yards corresponds to about 15 to 20 yards on the water, we see that, due to a moderate roll of 5 degrees, every round may be a miss, although the marksmanship of the layer be perfect. Under such conditions firing for individual hits is the merest futility; firing by salvo becomes imperative.

3. Air Spacing—When using reduced charges a considerable space exists between the end of the charge and the base of the shell. Wave pressures are likely to be set up, giving rise to irregular burning and irregular muzzle velocity.

4. Propellant—The acceptance limits of a lot of new powder define the probable variation or muzzle velocity from round to round. These limits become extended when lots of varying ages of different makes are in use, and, speaking generally, the mean velocity from any one lot shows a progressive fall with age.

5. Projectile—Three qualities of projectiles which effect the ballistic co-efficient—size, weight, balance, etc.—will vary from round to round. The limits of variation are determined mainly by questions of expense in manufacture and inspection.

6. Steadiness—The co-efficient of steadiness is affected by the position of the centre of form, the speed rotation, initial centering and the actual gun elevation. Projectiles in the descending branch of high-angle trajectories become increasingly unstable as the elevation is increased.

Laying—As a rule, layers have a personal prejudice for laying either high or low, and in a bad light, in rain and mist, or when fatigued, excited or impatient, they tend to exaggerate their specific defect. All laying depends on the personal judgment of the layer—the attainment of a state of mental satisfaction, in which a condition of equilibrium is established between the feeling that "that is near enough" and the adjustment of muscular effort required to make it nearer. Most heavy guns are more easily depressed than elevated, and when following a target in a seaway the gun tends to take charge in depression, and is a very fatiguing mass to control in elevation. When laying by clinometer, if the bubbles be very lively, the layer becomes impatient, whereas, if the bubble be sluggish, the error of elevation depends on whether the lost motion of setting be in elevation or depression.

Jump—Jump is very considerable with field carriages on bad ground, and in the case of naval mountings varies not only with the same mounting in different parts of the ship, but also when the gun is trained on different bearings. Mountings carried on a pedestal with a ball race of small diameter, particularly if they are balanced mountings, are extremely unstable, the jump varying between positive and negative limits of as much as half a degree. Errors of elevation with those mountings are also caused by the movements of the gun members on the platform and by the tilting of the mounting by the thrust at the elevation arc. With hydro-pneumatic mountings the recoil and angle of departure are greatly affected by the mere rate of fire, the frothing of the liquid and the liberation of air being dependent on the time interval of rest between the rounds.

Dials—The dials are graduated from a calculated range that has been correlated to the shooting of one or more guns of the particular nature. Any individual gun, however, may range consistently short or over, due to some peculiarity not possible to define.

Instruments—There are a considerable number of instrumental errors which arise mainly from imperfect adjustment, such as telescopes out of alignment, displacement of the zero reading of dials, range finders out of level or incorrectly datumed, tide gages incorrectly set, etc., that give a permanently loaded error to the shooting of the gun.

Droop—This is caused by the heat strains of unequal cooling during manufacture or by a lack of girder stiffness. In both cases perceptible modifications of the droop are brought about during firing or by the heating effect of mere sunshine. Cases have been met where the bend of field guns is beyond the condemning limit when measured in the gun park, but four or five minutes less after the guns had been heated by exposure to a tropical heat for three hours.

Choke and Metallic Fouling—The effect of choke and metallic fouling is not only to increase bore resistance and thus cause variable muzzle velocities, but also to make one gun differ from another of the same nature at the same period of its life. The effect depends on whether the choke or coppering occurs in such a position that the fate of burning of the charge is affected by lowering the normal rate of explosion of the bore gases. Heavy guns, which copper rapidly, may lose as much as fifty yards per round at 5,000 yards.

Driving Band—When projectiles are fired for recovery their driving bands are found to be fanned, eccentric, worn smooth or multiply engraved. This irregular action implies variable engraving and rifling resistance, and, in consequence, variable muzzle velocity. In addition, with long shell, or with a gun eroded at the commencement of the rifling oblique loading results, and heavy groove marking on the body of the shell itself.

Wear and Windage—Wear at the commencement of the rifling gives rise to over-ramming and to an engraving resistance less than that normal for a new gun. Heavy guns have a rapid rate of wear and rapid rate of fall of muzzle velocity for about the first eighty rounds of their life, a feature that is not exhibited by guns below about 51 inches calibre, these latter having a greatly diminishing rate of fall of muzzle velocity through their life. General wear of the bore gives rise to gas escape, fusing the driving band, irregular rotation and a fall of muzzle velocity.

Wet Chamber—This is a fruitful cause of lack of agreement between performance and intention. When charges are burning in a gun the principal mode of heat loss to the wall is by radiation. The magnitude of this heat loss is not generally appreciated, although it is of the order of 10 per cent. of the total heat of combustion. The most important practical fact to remember, however, is that the rate of absorption of radiant heat greatly depends on the mere condition of the surface difference of polish or of wetness hardly perceptible to the eye, causing a considerable change in the rate of heat transfer. Water in the chamber affects the ballistics in two ways. Water being opaque to radiant heat reduces the initial heat loss to the walls by radiation, and water left in the chamber after sponging out absorbs heat on being converted into steam. The initial greasiness of the gun in its effect on radiation, may explain the "mystery" of the first round. The quantity of water left in the chamber depends largely on the drill, and also on the shape of the chamber and the elevation of the gun. Quick-firing guns with fixed ammunition are not liable to this source of error.

Ramming—Just as an over-rammed projectile causes a loss of muzzle velocity, so also does the slipping back of a projectile cause a rise of

## TRIALS OF FARMER IN TOWN.

Found it Unbelievably Hard to Separate Luxuries From Necessities.

A farmer sold his property to live in the city, because his city friends "wore good clothes, had money in their pockets, went to the movies, belonged to clubs and enjoyed a yearly vacation." He found, however, that the city man pays dearly for these luxuries.

"We came to know," he said, "that it was just as hard for the city man to get up at 7 o'clock in the morning as it was for the country man to get up at 5. Why so? Because he must not relax; he is ever on duty. He must smile at this person. He dares not notice any one's peculiarities or oddities or unreasonableness. The result is he must find his relaxation in the evening; therefore, the family rarely gets to bed before 10 or 11 o'clock, and 7 in the morning finds them just as sleepy and far less refreshed than 5 found him on the farm.

"We found going to work for somebody else every day in the year except Sunday and perhaps a two weeks' vacation, under somebody else as manager, didn't exactly suit our country spirit of freedom. We came to know that our friends saved scarcely a cent; and, furthermore, one couldn't exactly see how they were extravagant. In the city it seems unbelievably hard to separate luxuries from necessities."—Philadelphia Public Ledger.

## In the Ocean Graveyard.

One very satisfactory explanation of the high rates now being charged for shipping cotton abroad will be found in the marked disappearance of ships as a consequence of the war. The significant fact stands out that in the 17 months during which there has been fighting at sea, nearly 2,000,000 tons of ships have been sunk. This tonnage was represented by 990 vessels of all kinds. The record for England is 602 ships, with a tonnage of 1,192,551. Against this is a German loss of 65 ships, with a tonnage of 161,888. The United States, not at war, has lost seven vessels representing a tonnage of 14,087. Lloyd's Register Book for 1915-16 places the entire British tonnage at 1,732,700, and by these figures England's tonnage now afloat amounts to but 540,159. On the other hand, Germany's tonnage has been reduced from 4,706,027, leaving afloat at this time, 4,544,139. The figures are for steam and sailing vessels. In the losses are included 50 steamers of over 5,000 tons, but the giant victim was the Lusitania, with a tonnage of 30,396. There should be no confusion of ships on which Americans were lost and American-owned ships. As indicated the latter have been few, the William P. Frye being the most notable. That ship was sunk by a German cruiser. Of the remaining six, four were sunk by striking mines.—Charlotte Observer.

## Girl Soldiers? No!

A full battalion of girls, physically vigorous, well balanced and able-bodied, prepared and trained to fight and thoroughly armed, would be a great asset to our country.—Mrs. Putnam, at Vassar college.

An asset in the show business, but in war a liability, like the Prince of Wales at the front.

"There is no such thing as sex inferiority," says Mrs. Putnam, and in the large sense that is true. But in details, like soldiering, there is inferiority, and she tells some of the reasons for it: Because "a man has a stronger physique \* \* \* and more nervous and emotional stability than a woman."

Why train first-rate girls to make second-rate soldiers when there are enough men for that industry? In an extremity, when men are scarce, there is something to be said for it.—Life.

## Growing.

Little Sydney had reached the mature age of three, and was about to discard petticoats for the more manly raiment of knickerbockers, says the New York Times. The mother had determined to make the occasion a memorable one. The breakfast table was laden with good things and the newly breeched infant was led into the room.

"Ah!" exclaimed the proud mother, "now you are a little man!"

Sydney was in ecstasies. Displaying his garments to their full advantage, he edged close to his mother and whispered:

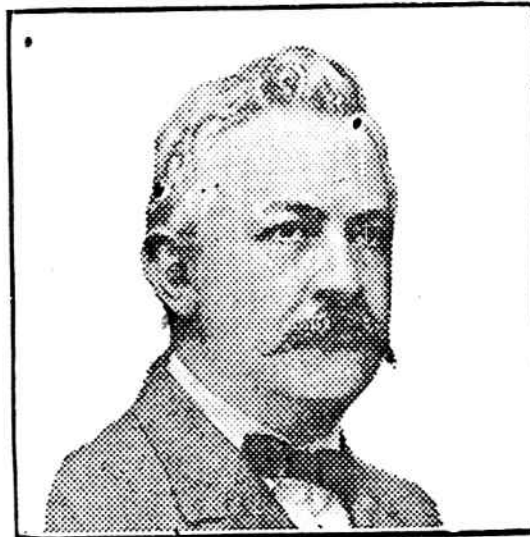
"Can I call pa Bill now?"

muzzle velocity. A six-inch shell, slipping back six inches, may be expected to give a maximum pressure of 15 tons above the normal and an increase of muzzle velocity of about 60 feet per second.

External Ballistics—The general external ballistic conditions, particularly the extent, direction and speed of gusts of wind, are quite indeterminate, and the errors of direction and range to which they give rise are entirely beyond prediction.

REXALL ORDERLIES  
THE IDEAL LAXATIVE

Prominent New Orleans Druggist is Authority For This Statement



P. A. CAPDAU

who owns and operates one of the big stores in New Orleans, says:

"I am of the opinion that Rexall Orderlies are the ideal laxative for men, women and children. This opinion is based upon my knowledge of the formula and upon what my customers say about them. Through personal experience, I know they are pleasant to take, gentle in action, and give the same pleasing results when used by men, women or children."

We have the exclusive selling rights for this great laxative. Trial size, 10 cents.

**MACK'S DRUG STORE**  
THE REXALL STORE

PORTABLE AND STATIONARY  
ENGINES

## AND BOILERS

Saw, Lath and Shingle Mills, Injectors, Pumps and Fittings, Wood Saws, Splitters, Shafts, Pulleys, Belting, Gasoline Engines

LARGE STOCK AT  
**LOMBARD**

Foundry, Machine, Boiler Works.  
Supply Store.

AUGUSTA, GA.

## Piles Cured in 6 to 14 Days

Your druggist will refund money if PAZO OINTMENT fails to cure any case of Itching, Blind, Bleeding or Protruding Piles in 6 to 14 days. The first application gives Ease and Rest. 50c.



Best material and workmanship, light running, requires little power; simple, easy to handle. Are made in several sizes and are good, substantial money-making machines down to the smallest size. Write for catalog showing Engines, Boilers and all Saw Mill supplies.

**LOMBARD IRON WORKS & SUPPLY CO.**

Augusta, Ga.

To Drive Out Malaria  
And Build Up The System

Take the Old Standard GROVE'S TASTELESS CHILL TONIC. You know what you are taking, as the formula is printed on every label, showing it is Quinine and Iron in a tasteless form. The Quinine drives out malaria, the Iron builds up the system. 50 cents

## FRANCIS F. CARROLL

Attorney-at-Law

Office Over Bamberg Banking Co.

GENERAL PRACTICE.

BAMBERG, S. C.

## RUB OUT PAIN

with good oil liniment. That's the surest way to stop them. The best rubbing liniment is

MUSTANG  
LINIMENT

Good for the Ailments of  
Horses, Mules, Cattle, Etc.

Good for your own Aches,  
Pains, Rheumatism, Sprains,  
Cuts, Burns, Etc.

25c. 50c. \$1. At all Dealers.

## R. P. BELLINGER

ATTORNEY AT LAW

Office Over Bamberg Banking Co.

General Practice

Invigorating to the Pale and Sickly

The Old Standard general strengthening tonic, GROVE'S TASTELESS CHILL TONIC, drives out Malaria, enriches the blood, and builds up the system. A true tonic. For adults and children. 50c

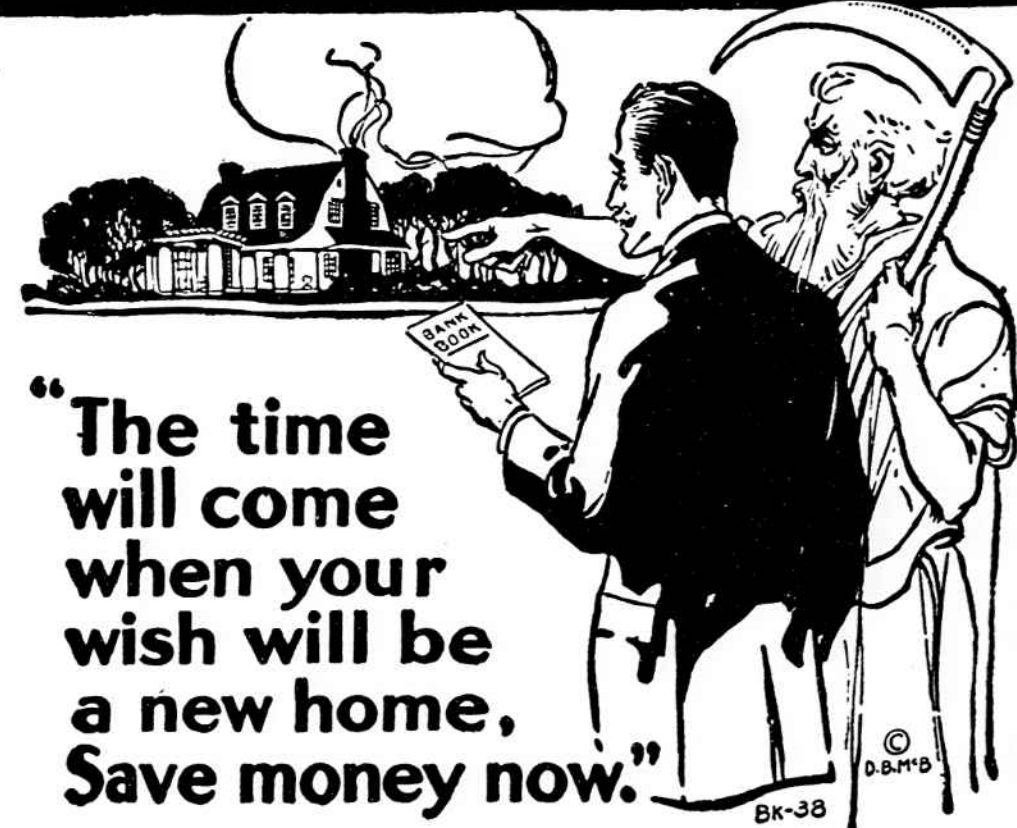
## LIFE, FIRE, LIVESTOCK

HEALTH and ACCIDENT  
INSURANCE

Agent for Superior Monument Co.  
Can Save you Money on Tombstones.

**W. MAX WALKER**

EHRRARDT, S. C.



Small savings have been in many instances the means of making the first payment on a home.

The fact that you have a Bank account brings about a confidence which results in better terms of purchase than you could make if you did not save. It is not so much the money as it is the standing a Bank account gives you—That's where we can help you. Begin with one dollar.

4 per cent Interest Paid on Savings Deposits.

## PEOPLES BANK

Bamberg, - - - - - South Carolina

## YOUR GROCERIES

ARE YOU SATISFIED WITH THEM? IF NOT, GIVE ME A TRIAL. I KNOW HOW TO BUY AND SELL GROCERIES, AND I CAN PLEASE YOU.

## Good Goods—Low Prices

I APPRECIATE ALL THE BUSINESS GIVEN ME, AND WILL DO ALL IN MY POWER TO MAKE IT PROFITABLE FOR YOU TO DEAL WITH ME.

## J. J. BRABHAM, JR.

"THE LIVE WIRE GROCER."

BAMBERG, S. C.



Which of the young men like those in this picture will hold his job if one of them is to be let out? Which one may be discharged if he does not CHANGE his habits?

Just this sort of a thing is going on every day with young men—young men and OLDER ones.

Do some THINKING and YOU will put money in our BANK.

Make OUR bank YOUR bank

We pay 4 per cent. interest, compounded quarterly on savings deposits

## Farmers &amp; Merchants Bank

EHRRARDT, S. C.